MAPPING CROPPING SYSTEMS IN WEST AFRICA USING MODIS IMAGERY

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Introduction

To predict and respond to food security, early warning systems programs focus on mapping cropland extent, crop type, crop condition and estimating the potential crop yields of seasonal production.. Remote sensing plays an important role in delivering accurate and timely information for early warning systems.

We assume that a rural landscale can be characterized by its phenology and its particular structure. Thus, we used spectral, spatial and textural indicators of moderate-resolution images to:

i) build a common and effective method for mapping cultivated domain in Mali

ii) investigate **the applicability of combining agricultural database and MODIS time series, for producing maps of cropping systems at he national scale.**

I. Study Area

Mali displays a South-North climatic gradient and as for other African countries, food security relies on a adequate supply of rainfall during the monsoon season. Farming is the main source of income for many people of the Sudano-Sahelian region, with millet and sorghum as the major food crops, and cotton as cash crop. Malian agriculture is generally familiar, non intensive, and very fragmented.

An effective method for estimating the areal coverage of cultivated domain in Mali was previously built (Fig.1).

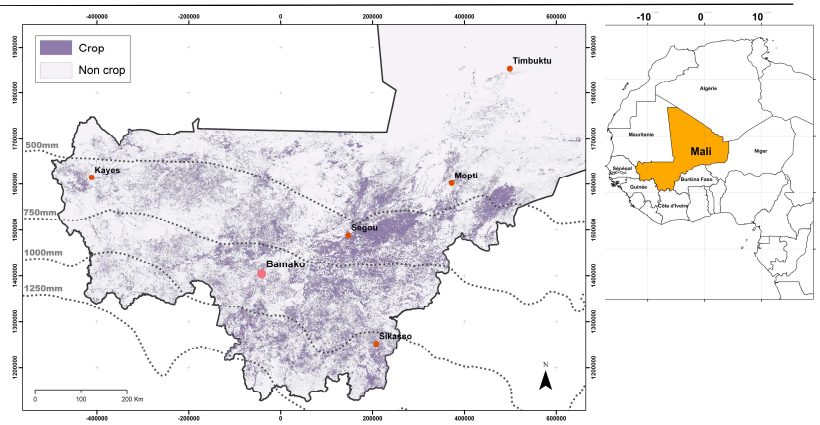


Fig.1 : *Cultivated area in Mali estimated using the stratified MODIS time series.* (Vintrou et al., in revision)

II. Method

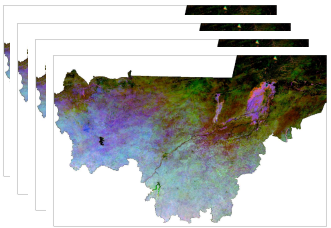
Agricultural database

IER database on cropping systems in 75 villages of South Mali

- % cotton
- % maize
- % millet
- % sorghum

X

Remote-sensing data



16-day MODIS NDVI times series (2007)

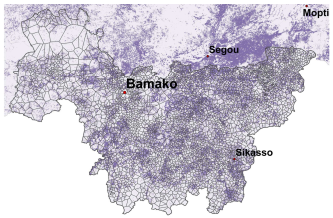
Typology of crop systems by experts analysis :
Type 1 : Millet and Sorghum > 50% and cotton < 10%
Type 2 : Maize and cotton > 40%
Type 3 : Sorghum > 20% and 5% < cotton < 40%

How to combine these 2 sources of information ?

Step 1 : Choice of the village spatial unit

IER database at village scale

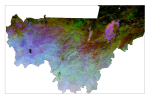
Thiessen polygons in South Mali



Step 2 : Extraction of attributes

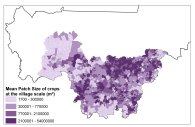
To characterize cultivated landscapes, 28 attributes were extracted, based on:

- NDVI

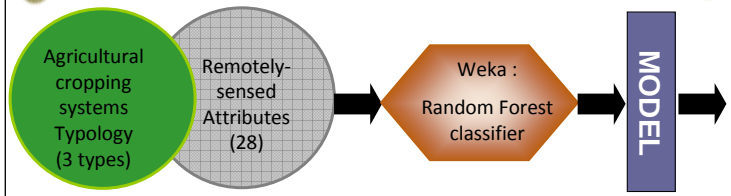


- texture

- fragmentation



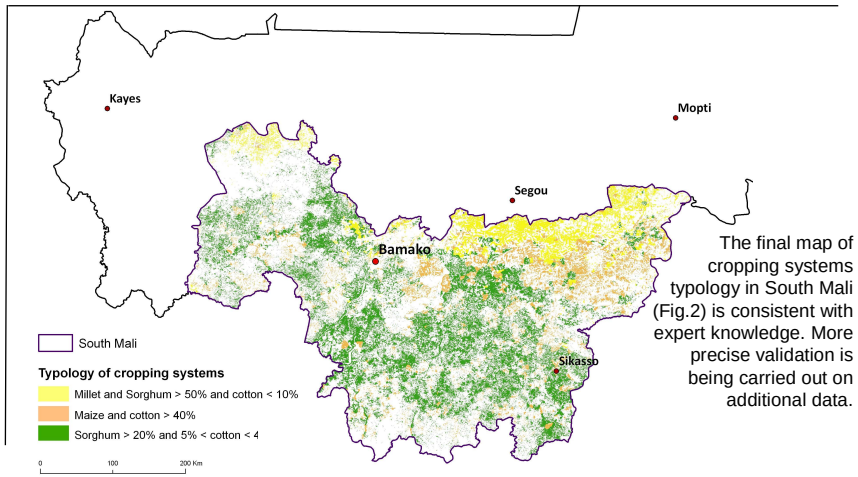
Step 3 : building a model with Random Forest



Step 4: Prediction with Random Forest

Random Forest is an "ensemble learning" method. We used the Weka software classifier "randomForest". First, the classifier is trained on 75 villages, so as to build a model of prediction. Then, we applied the model on the 4000 Thiessen polygons of South Mali. The model built in step 2 will assign one type label from the typology to every polygon of South Mali. Finally, we combined this classification with the crop mask.

III. Preliminary results and validation



The final map of cropping systems typology in South Mali (Fig.2) is consistent with expert knowledge. More precise validation is being carried out on additional data.

Fig.2 : *Typology of cropping systems in South Mali: three classes at the village scale.*

IV. Conclusion

Crop production systems of Mali can be characterized using MODIS land cover data combining agricultural database. Despite a high fragmentation of the rural landscape and the difficulty to distinguish natural vegetation and crops, our method constitutes a satisfactory improvement in the mapping of cropping systems at the village level.